

SERUM CALCIUM LEVELS IN PATIENTS WITH ESSENTIAL HYPERTENSION AND THEIR FIRST DEGREE RELATIVES

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ABSTRACT

Calcium plays an important role in the pathophysiology of essential hypertension. Serum calcium levels were measured in 117 subjects with essential hypertension and 77 first-degree relatives. The results showed that serum calcium levels were significantly ($p < 0.01$) decreased in both males and females with essential hypertension and their first-degree relatives when compared with the normotensive controls. This is the first study in Indian population.

KEY WORDS

Hypertension, First-degree relatives, Serum calcium, vascular tone.

INTRODUCTION

Hypertension is an asymptomatic and important disease of modern civilized life. The overall prevalence of hypertension has been reported to range from 6-32% (1).

Essential hypertension is associated with disturbed calcium metabolism. The calcium ion plays a major role as an intracellular second messenger in excitation contraction coupling in cardiac and smooth muscle cells. An increase in peripheral vascular resistance was a uniform finding in all types of established hypertension. The free intracellular calcium concentration determines the tension in vascular smooth muscle cells thereby resulting in peripheral vascular resistance. An increased calciuria could be a feature of the essential hypertensive patients (2).

Abnormalities of calcium metabolism have been described in patients with essential hypertension Zidek *et al.* (3) found an increased intracellular calcium activity in normotensive subjects with a familial hypertensive disposition in comparison with normotensives without family history of hypertension. Touyz *et al.* (4) showed significantly increased intracellular calcium levels in essential hypertensives. Some authors (5, 6) have reported lower concentrations of serum calcium in the hypertensives than in normotensive subjects. In the present investigation, serum calcium levels were studied in essential

hypertensive patients and their first-degree relatives.

MATERIALS AND METHODS

One hundred and seventeen confirmed untreated essential hypertensive patients referred from cardiology unit of Osmania University General Hospital and Osmania University Health Centre, Hyderabad and their 77 first degree relatives (33 sibs and 44 offspring) were included in the study group. One hundred and sixty persons with normal blood pressure and without family history of hypertension were taken as normotensive age and sex matched controls.

Estimation of Calcium

The serum calcium levels were estimated by atomic absorption spectrophotometer (AAS) according to the method of Zettner and Seligson (7).

Procedure

Serum (50 μ l) was diluted forty fold with 0.01% LaCl_3 , mixed well and then centrifuged at 3500 rpm for 10 minutes. The concentration of calcium present in the supernatant was determined by atomic absorption spectroscopy. The standards of different Ca concentrations (i.e., 0.625, 1.25, 2.5, 3.75 and 5 $\mu\text{g/ml}$) were prepared from stock standard. The standards and samples were read against the blank solution. The OD of samples, standards and blank was noted. The concentration of calcium in the serum was calculated by reading from the standard curve.

RESULTS

The serum calcium levels (m mol/l) in hypertensives and the first-degree relatives are shown in table-1. The mean serum calcium levels in males and females were 2.53 ± 0.26 and 2.51 ± 0.21 (m mol/l) respectively

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Table 1 : Serum calcium levels in essential hypertensives and first degree relatives

Sex	Serum Calcium Levels (m mole/l)					
	Hypertensives		Controls (I)		FDR	
	n	Mean \pm S.D.	n	Mean \pm S.D.	n	Mean \pm S.D.
Males	42	2.27 \pm 0.36	68	2.53 \pm 0.26	44	2.41 \pm 0.25
Females	44	2.20 \pm 0.35	62	2.51 \pm 0.21	33	2.44 \pm 0.23
Total	86	2.23 \pm 0.36*	130	2.52 \pm 0.24	77	2.42 \pm 0.24*

FDR : First Degree Relatives

P < 0.01

in control (I) group and the same were significantly ($p < 0.01$) decreased in males (2.27 ± 0.36) and females (2.20 ± 0.35) in hypertensive group. The mean serum calcium level in control (I) was 2.52 ± 0.24 as against 2.23 ± 0.36 in hypertensives. In the first-degree relatives also the calcium level was significantly decreased (2.42 ± 0.24 , $p < 0.01$) when compared with the controls (II) (2.53 ± 0.22).

DISCUSSION

The present study shows significantly reduced serum calcium in hypertensives and the results are in close agreement with that of others (5, 8) who also found a significant decrease in serum calcium in patients with essential hypertension. Reichel *et al.* (9) also reported reduced calcium in males with elevated diastolic blood pressure. However, Kosch *et al.* (10) did not find any change in serum calcium levels in hypertensives. In the present study the serum calcium levels in first-degree relatives were also significantly lower when compared with controls. So far there are no studies on serum calcium levels in first-degree relatives of hypertensives.

Abnormal cellular ion transport resulting in altered membrane control over intracellular calcium may be related to essential hypertension. Changes in magnesium levels may contribute to altered cell membrane calcium binding in essential hypertension (11).

The free intracellular calcium concentration determines the tension in vascular smooth muscle cells, thereby resulting in peripheral vascular resistance. Calcium has direct effect on peripheral vascular tone (12).

Alterations in intracellular calcium are thought to be involved in the common pathway mediating the secretion and action of many hormones, including the pressor action of catecholamines and angiotension II. Intracellular calcium may be involved in regulation of blood pressure. Calcium regulating hormones like 1, 25 dihydroxy vitamin D, levels of plasma rennin activity, circulating ionized calcium contribute to the pathophysiology of essential hypertension (13, 14).

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